Comments on: "Proposal for Raman x-ray free electron laser"by Ph. Balcou, Eur. Phys. J. D 59, 525 (2010)[a]

A. Zholents[1],

[1]*Advanced Photon Source, Argonne National Laboratory*
Argonne, IL 60439

M. Zolotorev[2]
[2]*Lawrence Berkeley National Laboratory,*
Berkeley, CA 94720

Submitted to European Physics Journal D

[a]Work supported by the U. S. Department of Energy, Office of Science, Office of Basic Energy Sciences, under Contract No. DE-AC02-06CH11357.

Comments on:

"Proposal for Raman x-ray free electron laser"

by Ph. Balcou,
Eur. Phys. J. D 59, 525 (2010)

A. Zholents[1], and M. Zolotorev[2]

[1]Advanced Photon Source, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439, e-mail: azholents@aps.anl.gov
[2]Lawrence Berkeley National Laboratory, 1 Cyclotron Road, Berkeley, CA 94720

Submitted 9/15/2010

Equation (13) in this paper defines the force experienced by the electron moving in z direction with velocity v_z due to the x-ray wave propagating in the z direction, with electric field E_1 pointing in the y direction, and magnetic field B_1 pointing in the x direction as

$$\vec{F}_1(t) = -eE_1 \cos(\omega_1 t - k_1 z)\vec{e}_y \ . \qquad (1)$$

In our opinion, when calculating this force one should also include the impact of the x-ray wave's magnetic field and obtain

$$\vec{F}_1(t) = -e(E_1 - \frac{v_z}{c}B_1)\cos(\omega_1 t - k_1 z)\vec{e}_y \approx -\frac{eE_1}{2\gamma^2}\cos(\omega_1 t - k_1 z)\vec{e}_y \qquad (2)$$

Here c is the speed of light and γ is the electron relativistic factor. As a result, one would need to change E_1 to $E_1/2\gamma^2$ in all the following equations in the cited paper (except the wave propagation equations Eq. (23) and Eq. (34)). We believe that a similar omission of the impact of the magnetic field appears in Eq. (28). Consequently, the formula for the gain (Eq. (37) in the cited paper) should also include the factor $1/2\gamma^2$. This is a rather significant modification considering that relativistic electrons with values of γ ranging from approximately 20 to approximately 300 are used in the numerical examples.